IN THE CLAIMS

The following listing of the claims is provided in accordance with 37 C.F.R. 1.121:

1. (original) A method of re-engineering a part comprising:

generating a parametric master model for the part from an editable geometry for the part;

generating a manufacturing context model from a design master model, the design master model comprising the parametric master model and the manufacturing context model comprising a plurality of tooling features; and

creating a tooling master model from the manufacturing context model, the tooling master model comprising a tooling geometry for the part.

2. (original) The method of Claim 1, further comprising:

obtaining data characterizing the part; and

generating the editable geometry for the part from the data.

3. (original) The method of Claim 2, wherein said obtaining comprises measuring the part to obtain the data.

4. (original) The method of Claim 3, wherein said measurement comprises performing at least one of digital radiography and optical scanning.

5. (original) The method of Claim 2, wherein the data comprise geometric data for the part.

6. (original) The method of Claim 5, wherein the data further comprise attribute data for the part.

7. (original) The method of Claim 5, wherein said generation of the editable geometry for the part comprises:

generating a non-parametric computer aided design (CAD) model for the part from the geometric data; and

reconstructing the non-parametric CAD model to obtain the editable geometry, said reconstruction comprising performing reverse CAD modeling.

8. (original) The method of Claim 7, wherein said generation of the non-parametric CAD model for the part comprises:

reducing the data to obtain a subset of the data,

segmenting the subset to obtain a plurality of feature subsets of the data, each feature subset corresponding to a feature of the part,

performing geometric feature extraction to obtain a plurality of curves and surfaces from the feature subsets, the curves and surfaces characterizing the features of the part, and

importing the curves and surfaces into a computer aided design (CAD) geometry to obtain the non-parametric CAD model.

9. (original) The method of Claim 1, further comprising obtaining the editable geometry from legacy design information.

10. (original) The method of Claim 1, wherein said generation of the parametric master model comprises identifying and extracting a plurality of critical parameters from the editable geometry.

11. (original) The method of Claim 10, wherein said extraction of the critical parameters comprises:

applying a plurality of knowledge based engineering (KBE) part design generative rules to the editable geometry to obtain the parametric master model, and

applying a plurality of KBE part design checking rules to the parametric master model to ensure that the parametric master model satisfies a plurality of functional and manufacturability requirements.

12. (original) The method of Claim 1, further comprising creating at least one design analysis context model, the design analysis context model comprising an associative copy of the parametric master model which is configured for performing an engineering analysis.

13. (previously presented)The method of Claim 12, wherein at least two design context models are created, each of the design context models being configured for performing a different engineering analysis.

14. (original) The method of Claim 12, further comprising preparing the design analysis context model for performance of the analysis, said preparation comprising:

meshing the design analysis context model using the analysis code guidelines to obtain a meshed design model, and

mapping a plurality of boundary conditions onto the meshed design model using the analysis code guidelines to obtain a design analysis model,

the method further comprising:

performing the engineering analysis on the design analysis model to obtain a plurality of engineering analysis data, said performance comprising executing an engineering analysis code using the design analysis model and a plurality of convergence criteria; and

evaluating the engineering analysis data and, if the engineering analysis data are unsatisfactory, said method still further comprising:

modifying the parametric master model using a plurality of redesign goals, and

repeating said performance of the engineering analysis after modifying the parametric master model.

15. (original) The method of Claim 1, further comprising processing the parametric master model with producibility data from a producibility database to add geometric dimensions and tolerances (GD&T) to the parametric master model, wherein the design master model comprises the parametric master model with geometric dimensions and tolerances.

16. (original) The method of Claim 15, wherein said generation of the manufacturing context model comprises:

orienting the parametric master model using the geometric dimensions and tolerances to obtain an oriented GD&T model; and

applying a plurality of manufacturing design rules to the oriented GD&T model to obtain the manufacturing context model.

17. (original) The method of Claim 16, wherein said generation of the manufacturing context model further comprises:

orienting the manufacturing context model to obtain the oriented GD&T model; and

applying the manufacturing design rules to the oriented GD&T model to generate the manufacturing context model encompassing at least one additional manufacturing step, wherein said orientation and application are performed for each of the additional manufacturing steps.

18. (original) The method of Claim 16, wherein the manufacturing design rules include a plurality of tooling design rules and wherein said creation of the tooling master model comprises applying the tooling design rules to the manufacturing context model to obtain the tooling master model, wherein the tooling geometry is derived from the tooling features by said application of the design rules.

19. (original) The method of Claim 16, further comprising creating at least one tooling context model comprising an associative copy of the tooling master model which is configured for performing a manufacturing process analysis.

20 (original) The method of Claim 19, wherein at least two tooling context models are created, each of the tooling context models being configured for performing a different manufacturing process analysis.

21. (original) The method of Claim 19, further comprising preparing the tooling context model for performance of the manufacturing process analysis, said preparation comprising:

meshing the tooling context model using the analysis code guidelines to obtain a meshed tooling model, and

mapping a plurality of boundary conditions onto the meshed tooling model using the analysis code guidelines to obtain a tooling analysis model,

said method further comprising performing the manufacturing process analysis on the tooling analysis model to obtain tooling analysis data, said performance comprising executing a manufacturing process analysis code using the tooling analysis model, a plurality of convergence criteria, and a plurality of process parameters; and

evaluating the tooling analysis data and, if the tooling analysis data are unsatisfactory, still further comprising:

modifying the tooling master model using a plurality of manufacturing goals tooling design tradeoffs, and

repeating said performance of the manufacturing process analysis after modifying the tooling master model.

22. (original) The method of Claim 16, further comprising adding a plurality of geometric dimensions and tolerances (GD&Ts) to tooling master model.

23. (original) The method of Claim 22, wherein the tooling master model further includes a plurality of process parameters, the method further comprising:

generating a hard tooling using tooling master model with the geometric dimensions and tolerances;

manufacturing at least one test part using the hard tooling and using the process parameters;

inspecting test part to obtain measurement data; and

assessing the measurement data to determine whether the test parts satisfy a plurality of engineering criteria for the part.

24. (original) A system for re-engineering a part comprising:

a part design master model module configured to generate a parametric master model for the part from an editable geometry for the part; and

a tooling master model module configured to receive the parametric master model, to generate a manufacturing context model from the parametric master model, and to create a tooling master model from the manufacturing context model, wherein the manufacturing context model comprises a plurality of tooling features and the tooling master model comprises a tooling geometry.

25. (original) The system of Claim 24, wherein said part design master model module comprises:

a computer aided design (CAD) system configured to generate the parametric master model from the editable geometry; and

a knowledge based engineering (KBE) environment configured to apply a plurality of knowledge based engineering (KBE) part design generative rules to the editable geometry to obtain the parametric master model, and to apply a plurality of KBE part design checking rules to the parametric master model to ensure that the parametric master model satisfies a plurality of functional and manufacturability requirements.

26. (original) The system of Claim 25, wherein said CAD system is further configured to generate the editable geometry from data characterizing the part.

27. (original) The system of Claim 25, wherein said part design master model module further comprises:

a linked model environment configured for creating at least one design analysis context model, the context model comprising an associative copy of the parametric master model and being configured for performing an engineering analysis; and

an engineering analysis code for performing the engineering analysis to generate engineering analysis data for evaluating the parametric master model.

28. (original) The system of Claim 27, wherein said part design master model module further comprises a part data management (PDM) system configured to store operating condition data for deriving a plurality of boundary conditions, wherein said linked model environment is configured to link said PDM system to a meshed design model obtained from the design analysis context model, to map the boundary conditions onto the meshed design model.

29. (original) The system of Claim 25, wherein said CAD system is further configured to process the parametric master model with producibility data to add geometric dimensions and tolerances to the parametric master model.

30. (original) The system of Claim 24, wherein said tooling master model module comprises:

a tooling computer aided design (CAD) system configured to receive the parametric master model, to orient the parametric master model after processing with a plurality of geometric dimensions and tolerances to obtain an oriented GD&T model, and to generate the manufacturing context model from the parametric master model; and

a tooling knowledge based environment configured to apply a plurality of manufacturing design rules to the oriented GD&T model to obtain the manufacturing context model.

31. (original) The system of Claim 30, wherein said tooling CAD system is further configured to generate the manufacturing context model for a plurality of manufacturing steps.

32. (original) The system of Claim 30, wherein the manufacturing design rules include a plurality of tooling design rules, wherein said tooling knowledge based environment is further configured to apply the tooling design rules to the manufacturing context model, and wherein said tooling CAD system is further configured to derive the tooling geometry from the manufacturing context model using the tooling design rules, to generate the tooling master model.

33. (original) The system of Claim 32, wherein said tooling master model module further comprises:

a tooling linked model environment configured for creating at least one tooling context model, wherein the tooling context model comprises an associative copy of the tooling master model and is configured for performing a manufacturing process analysis; and

a manufacturing process analysis code for performing the manufacturing process analysis to generate tooling analysis data for evaluating the tooling master model.

34. (original) The system of Claim 33, wherein said tooling master model module further comprises a tooling part data management (PDM) system configured to store a plurality of operating condition data for deriving a plurality of boundary conditions and a plurality of process parameters,

wherein said tooling linked model environment is configured to link said tooling PDM system:

to a meshed tooling model obtained from the tooling context model, to map the boundary conditions onto the meshed tooling model, and

to the manufacturing process analysis to supply the process parameters for performing the manufacturing process analysis.

35. (original) The system of Claim 33, wherein said tooling CAD system is further configured to add a plurality of geometric dimensions and tolerances (GD&Ts) to the tooling master model.

36. (original) A method of manufacturing comprising:

generating a parametric master model for a part from an editable geometry for the part;

generating a manufacturing context model from the parametric master model, the manufacturing context model comprising a plurality of tooling features;

creating a tooling master model from the manufacturing context model, the tooling master model comprising a tooling geometry for the part;

generating a hard tooling using the tooling master model; and

manufacturing at least one part using the hard tooling and a plurality of process parameters.

37. (original) The method of Claim 36, further comprising generating the editable geometry from data characterizing the part.

38. (original) The method of Claim 36, wherein said generation of the parametric master model comprises:

applying a plurality of knowledge based engineering (KBE) part design generative rules to the editable geometry to obtain the parametric master model, and

applying a plurality of KBE part design checking rules to the parametric master model to ensure that the parametric master model satisfies a plurality of functional and manufacturability requirements,

wherein said method further comprises creating at least one design analysis context model for evaluating the parametric master model, the design analysis context model comprising an associative copy of the parametric master model which is configured for performing an engineering analysis.

39. (original) The method of Claim 38, further comprising processing the parametric master model with producibility data from a producibility database to add geometric dimensions and tolerances (GD&T) to the parametric master model,

wherein said generation of the manufacturing context model comprises:

orienting the parametric master model using the geometric dimensions and tolerances to obtain an oriented GD&T model, and

applying a plurality of manufacturing design rules to the oriented GD&T model to obtain the manufacturing context model,

wherein the manufacturing design rules comprise a plurality of tooling design rules.

40. (original) The method of Claim 39, wherein the manufacturing context model is generated for a plurality of manufacturing steps.

41. (original) The method of Claim 39, wherein said creation of the tooling master model comprises applying the tooling design rules to the manufacturing context model to obtain the tooling master model, wherein the tooling geometry is derived from the tooling features by said application of the design rules.

42. (original) The method of Claim 41, further comprising creating at least one tooling context model comprising an associative copy of the tooling master model which is configured for performing a manufacturing process analysis.